Results of Airborne Backscatter Measurements During the Surface Wave Dynamics Experiment

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Abstract

Ocean backscatter data over a wide variety of oceanic and atmospheric conditions were obtained by the Jet Propulsion Laboratory NUSCAT KU-band scatterometer during the Surface Wave Dynamics Experiment (SWADE). Thirty hours of backscatter data were collected in ten flights by NUSCAT on the NASA Ames C 130 aircraft during an intensive observation period (IOP) of SWADE in the winter of 1991. The S WADE experimental area, off the coast of Virginia and Maryland, was deployed with an array of buoys providing appropriate in-situ measurements to correlate with the radar backscatter for incidence angles from 10° to 60° at both horizontal and vertical polarizations.

In a number of flight lines across the north wall of the Gulf Stream, NUSCAT data were acquired to observe backscatter variations over the sea surface temperature front at the Gulf-Stream boundary. During this IOP, the movement of the Gulf Stream in the SWADE area created complicated directional wave fields. Swells reached to 6 m in significant wave height. NUSCAT results indicate that the azimuth direction, at which the backseat tcr is maximum, is in bet wccn the wind direction and the dominant wave direction at light wind conditions. An examination of a direction wave spectrum at an intermediate wind speed shows that NU SCAT maximum direction aligned with high frequency wave components, which propagate at directions different from t hc pricipal wave direction. Excluding cases of large swells, there is no systematic trend between backscatter and significant wavc height, Relations of backscatter with wave age arc derived from the NUSCAT-SWADE data base at incidence angles from 10° to 40° for both horizontal and vertical polarizations. The trend of increasing backscatter with younger wave age agrees with a rougher surface condition for a younger wave field. Moreover, relations of backscatter with friction velocity, which relates to the momentum flux between ocean and atmosphere in the turbulent atmospheric surface layer, are derived from the same data set used in the wave age study. It is observed that backscatter arc more sensitive to friction velocity with smaller deviation factors compared to the backscatter functions of wave age.